U.S. Fish & Wildlife Service

Recovery Plan for the

Calyptranthes thomasiana

Southeast Region
Atlanta, Georgia

CALYPTRANTHES THOMASIANA RECOVERY PLAN

prepared by

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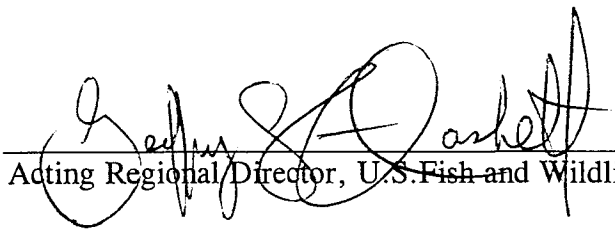
Approved: 
Acting Regional Director, U.S. Fish and Wildlife Service

Date: September 30, 1997

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By approving this document, the Regional Director certifies that the data used in its development represent the best scientific and commercial information available at the time it was written. Copies of all documents reviewed in the development of the plan are available in the administrative record, located at the Boqueron Field Office.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1997. *Calyptranthes thomasiana* Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 17 pp.

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Fish and Wildlife Reference Service
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EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR *CALYPTRANTHES THOMASIANA*

Current Status: *Calyptranthes thomasiana* is a small evergreen shrub or small tree, known only from the island of Vieques in Puerto Rico, one area in St. John, U.S. Virgin Islands, and from Gorda Peak, Virgin Gorda, British Virgin Islands. It is currently designated as endangered.

Habitat Requirements and Limiting Factors: *Calyptranthes thomasiana* is currently known from three locations. Its populations consist of approximately 210 individuals: 10 to 12 plants in Vieques; about 100 plants on St. John; and about 100 plants on Virgin Gorda. In Vieques the population is found on U.S. Navy property in moist deciduous forest at an elevation of 301 meters and on St. John the species is known from upland moist forest at an elevation of 387 meters.

Recovery Objective: Delisting.

Recovery Criteria: *Calyptranthes thomasiana* may be considered for downlisting when (1) an agreement between the Fish and Wildlife Service and the U.S. Navy has been prepared and implemented for the protection of the species; (2) an agreement between the Fish and Wildlife Service and the National Park Service for the protection of the species has been prepared and implemented; and (3) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation have been established in protected areas such as Vieques or St. John.

Actions Needed:

1. Protect the existing population and its habitat through an agreement with the U.S. Navy and National Park Service.
2. Develop a management plan for the species in cooperation with these entities.
3. Monitor known populations.
4. Enforce existing Commonwealth and Federal endangered species regulations.
5. Educate the public on conservation values and regulations.
6. Conduct research on the life history of the species and evaluate propagation techniques.
7. Conduct propagation and enhance existing populations or establish new ones on protected lands.

Date of Recovery: Delisting should be initiated in 2025, if recovery criteria are met.

Recovery Costs: Recovery costs for *Calyptranthes thomasiana* have been estimated at $86,000 for the first 3 years. Subsequent expenditures will depend upon the results of these preliminary studies; therefore, costs cannot be estimated at this time.

TABLE OF CONTENTS

PART I. INTRODUCTION

Calyptranthes thomasiana (no common name) is a small evergreen shrub or small tree, known only from the island of Vieques in Puerto Rico, one area in St. John, U.S. Virgin Islands, and from Gorda Peak, Virgin Gorda, British Virgin Islands. Modification and loss of habitat, coupled with low numbers and restricted distribution, represent the primary threats to this species.

This species was determined to be an endangered species on February 18, 1994, pursuant to the Endangered Species Act of 1973, as amended (U.S. Fish and Wildlife Service 1994). Critical habitat has not been designated for this species because of the risks of vandalism, as well as its potential for overcollection for use as an ornamental.

Description

Calyptranthes thomasiana was described in 1855 from specimens collected from St. Thomas, U.S. Virgin Islands. It is an evergreen shrub or small tree that may reach 10 meters (30 feet) in height and 13 centimeters (5 inches) in diameter. Leaves are opposite, obovate to oblong, 2 to 4 centimeters (3/4 to 1 3/4 inches) long, blunt at the apex, and short pointed at the base. The leaves are coriaceous, with gland dots, shiny on the upper surface, and dull on the lower surface. The inflorescences are subaxillary and the cymes trichotomous. Flower-buds are obovoid, apiculate, and 3 millimeters long. Flowers have four small, spatulate petals. The fruit has not been described (Liogier 1994).

Distribution/Population Status

Calyptranthes thomasiana is currently only known from three locations: Monte Pirata on the island of Vieques in Puerto Rico; Bordeaux Mountain on the island of St. John, U.S. Virgin Islands; and Gorda Peak in Virgin Gorda, British Virgin Islands (Figure 1). It was originally described from specimens collected from St. Thomas, U.S. Virgin Islands; however, it has not been reported from this island in recent years. It was previously thought to be endemic to Puerto Rico and the U.S. Virgin Islands, but was recently reported from Virgin Gorda, British Virgin Islands where it occurs within the National Park (Center for Plant Conservation 1992; G. Proctor, pers. comm.).

Approximately 10 to 12 individuals of *Calyptranthes thomasiana* are known to occur on Vieques near the summit of Monte Pirata. The site is located on U.S. Navy property and is in close proximity to naval communication facilities. On St. John, U.S. Virgin Islands, as many as 100 mature individuals are known from a small area (approximately 1.5 acres) on Bordeaux Mountain, which is within the Virgin Islands National Park, National Park Service, Department of the Interior (G. Ray, pers. comm., Woodbury and Weaver 1987). On Virgin Gorda, *C. thomasiana* is found within a National Park owned by the British Virgin Islands government. About 100 plants are known from the Gorda Peak locality (Center for Plant Conservation 1992, G. Proctor, pers. comm.).

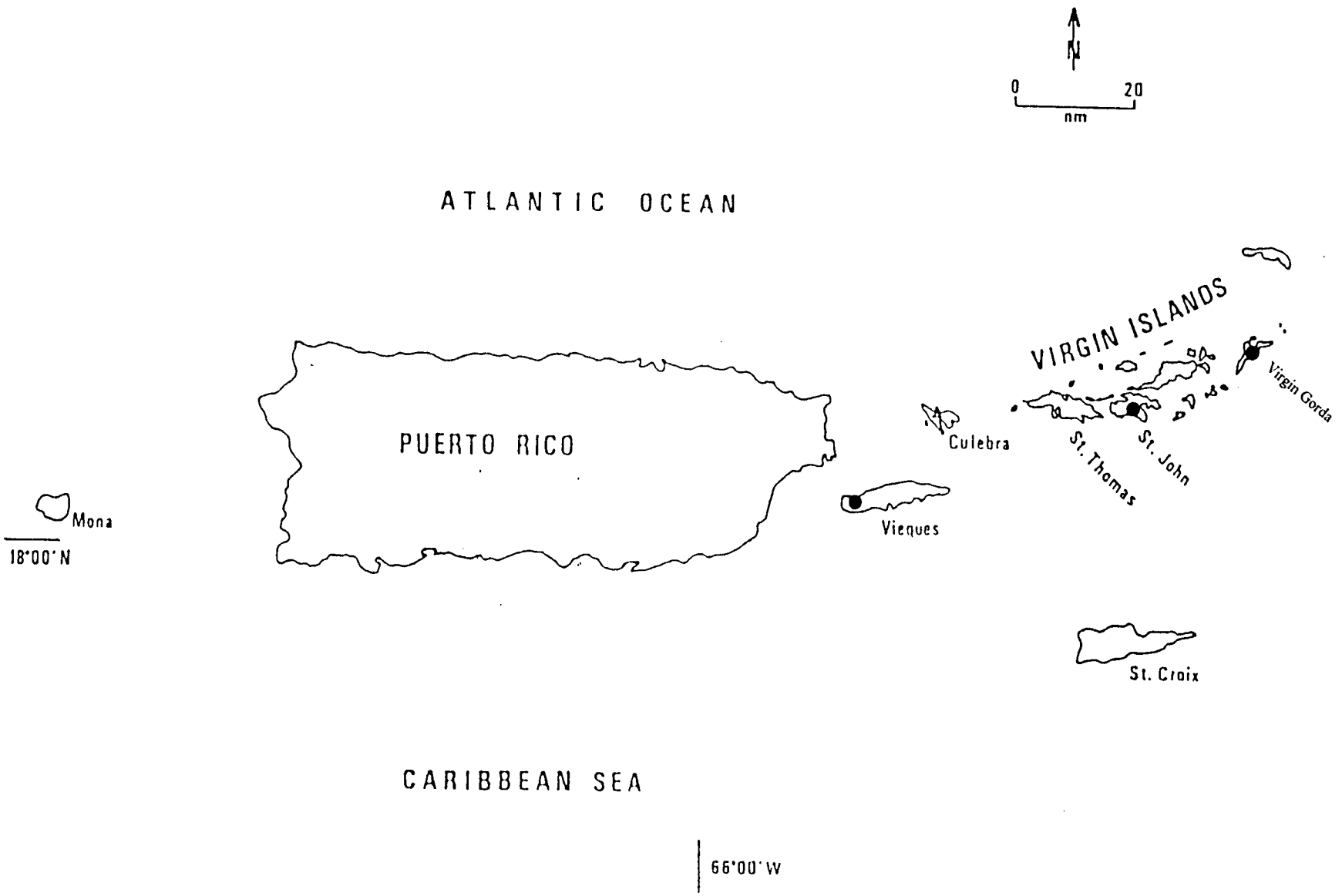

Figure 1. Distribution of known populations of *Calyptranthes thomasiana* (●).

Reproductive Status

Little is known about the reproductive biology of *Calyptranthes thomasiana*. The Center for Plant Conservation (1992) indicated that little recruitment had been observed in known populations. Nevertheless, the St. John population has been observed to have heavy seed production, germination and recruitment (E. Gibney, pers. comm.). Fruit has not been described in the literature. Two plants have been cultivated at Fairchild Tropical Gardens in Miami, Florida, apparently originally from the Flag Hill, St. Thomas locality (Center for Plant Conservation 1992).

Habitat Description

St. John, U.S. Virgin Islands

St. John is an island, volcanic in origin, approximately 5,180 hectares in size. The highest point, where the species is located, is Bordeaux Mountain at 387 meters above sea level. The island's topography is rugged, with 80 percent of the slopes greater than 30 percent and only 9 percent of the slopes equal to or less than 10 percent. No permanent streams are found on the island, although standing water may be found throughout the year in the larger drainages.

During the 18th and 19th century, much of the island was cultivated in crops such as sugar cane and cotton. Nevertheless, by the late 19th century many of the estates were abandoned and forest regenerated. Today much of the island is covered by secondary forest. In 1956, the Virgin Island National Park was established and today covers approximately 56 percent of the island.

Precipitation on St. John ranges from 890 to 1,400 millimeters per year, the majority of which is received between May and November. Relative humidity is about 75 percent and mean annual temperature 27°C. The highest and lowest temperatures recorded between 1921 and 1967 were 35°C and 15°C, respectively (Woodbury and Weaver 1987).

With the exception of a small area of limestone derived soils mear Mamey Peak, the soils of St. John are volcanic in origin and neutral to basic in reaction. The dominant series on the island is Cramer clay loam, characterized by moderately sloping to steep, shallow, well-drained soils. Drainage is good, run-off medium to rapid, and soil permeability moderate. Depth to bedrock ranges from 25 to 50 centimeters (Woodbury and Weaver 1987).

Ten vegetation types have been identified on the island of St. John: (1) mangrove, salt flat and lagoon; (2) upland moist forest; (3) gallery moist forest; (4) basin moist forest; (5) dry evergreen woodland; (6) dry evergreen thicket; (7) thorn and cactus; (8) rock pavement and coastal or scrub hedge; (9) secondary vegetation; and (10) pasture (Woodbury and Weaver 1987).

Calyptranthes thomasiana is found in the upland moist forest type at Bordeaux Mountain. At Bordeaux Mountain, the upland moist forest is best developed; nevertheless, this species is found on the windward side of the peak where the effects of the wind make it a drier forest type, with a lower canopy. Dominant species include: *Ilex urbanii, Myrcia citrifolia, Guettarda scabra, Clusia rosea, Psidium amplexicaule,* and *Acacia muricata* (E. Gibney, pers. comm.). *Calyptranthes thomasiana* is found in the lower strata of the forest. Epiphytes are not common, vines are scattered, and mosses are evident at the base of trees and rocks (Woodbury and Weaver 1987).

Monte Pirata, Vieques

Vieques Island is located in the Caribbean Sea, approximately 7 miles southeast of the main island of Puerto Rico. Vieques is a long narrow island, roughly 33 kilometers (20 miles) long and 7 kilometers wide (4.5 miles), which is about 133 square kilometers (33,000 acres) in size. The island is generally level with a low ridge of hills along the center. The highest elevation, 301 meters (981 feet), is Monte Pirata, in the southwest where the species is located.

Mean annual precipitation on Vieques is about 115 centimeters, with the wetter season extending from May to November and the dry season from December to April. Relative humidity in Vieques averages about 75 percent. Mean annual temperature is about 79.8°F with a record low of 60°F and a high of 98°F. Some authors indicate that the western part of the island is wetter than the eastern portion; nevertheless, others believe that the more xeric vegetation found on the eastern part is a result of the shallower soils. Vegetation on the western part, where the species is located, is more mesic in nature.

Vieques is composed of three major rock types: Upper Cretaceous volcanic rocks; Upper Cretaceous or Lower Tertiary intrusive rocks; and Upper Tertiary and Quaternary sedimentary rocks. Monte Pirata, composed of Cretaceous plutonic rocks, is steep and covered with large granodiorite boulders, some up to 20 meters in diameter.

The soils of Monte Pirata have been classified as Pandura-Very Stony Land Complex, 40 to 60 percent slope. This soil complex is characterized by shallow, well-drained soils that are moderately permeable and acidic in nature.

Vieques lies in two life zones as classified by Ewel and Whitmore (1973): (1) the subtropical dry forest life zone, covering about 66 percent of the island and, (2) the subtropical moist forest life zone at the higher elevations. Woodbury (1972) identified 9 vegetation types on Vieques which included the following: (1) sandy beach; (2) beach scrub; (3) dry evergreen beach woodland; (4) mixed dry evergreen and deciduous woodland of the rocky coastal slopes; (5) ucar forest; (6) seasonal forests of high moisture areas such as ravines and drainage areas; (7) moist deciduous formation of the inner hills and slopes; (8) thorn scrub; and (9) mangroves. *Calyptranthes thomasiana* is found in the moist deciduous formation of the inner hills and slopes, a forest type that also include semi-evergreen forests.

This forest type is characterized by trees which reach about 10 to 15 meters (30 to 45 feet) in height. From one-third to one-half of the species are deciduous. A lower strata is usually present and epiphytic orchids and vines are common. The most common species in the upper strata is *Coccothrynax argentea*. Other associated species include *Trichilia hirta, Citharexylum fruticosum, Eugenia fragans, Eugenia sessiliflora, Palicourea domingensis, Licaria triandra, Nectandra coriacea, Maytenus elliptica, M. cymosa, and Miconia laevigata.* The large boulders found throughout are covered by bromeliads.

Reasons For Listing

Calyptranthes thomasiana occurs at only three locations, two of which are within the jurisdiction of the United States. One of the most serious factors affecting this species is its limited distribution and rarity. Although on Vieques Island *Calyptranthes thomasiana* is found on U.S. Navy property, the area has been severely modified in the past for the construction of Navy facilities. Although currently located in a conservation zone, any expansion of the facilities would eliminate individuals. The risk from damage from events such as hurricanes is high. Hurricane Hugo in 1989 dramatically affected the area of Monte Pirata, felling large trees and creating numerous canopy gaps.

While known individuals on St. John are found within the National Park, these may be affected by park management practices. Feral donkeys, goats, and pigs are present in the area and may be responsible for the uprooting of seedlings on the slopes where the population is located. Slippage of the road adjacent to the population may result in the loss of plants.

Conservation Measures

Conservation measures provided to federally listed species include: recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private groups and individuals. The Endangered Species Act provides for possible land acquisition in cooperation with the States and requires that

recovery actions be carried out for all listed species. Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is listed as federally endangered or threatened. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Fish and Wildlife Service.

Both the U.S. Navy and the National Park Service are aware of the presence of the species on their land. On Monte Pirata in Vieques, the species occurs within an ecological conservation zone, designated so by a 1983 Memorandum of Understanding. The Land Use Management Plan for Naval Facilities at Vieques indicates that any proposed development within the zone must be approved by the Management Advisory Committee.

Two plants are present at the Fairchild Tropical Gardens in Miami, Florida, apparently propagated from material collected at Flag Hill, St. Thomas, U.S. Virgin Islands.

Summary of Comments Received

Copies of the Technical/Agency Draft Recovery Plan for *Calyptranthes thomasiana* were sent to 13 reviewers, including three peer reviewers, for review and comments. A notice of availability of the Technical/Agency Draft was published in the *Federal Register*. Three letters of comment were received. Comments providing supplemental data were incorporated into the appropriate sections of the recovery plan.

The U.S. Navy, in a letter from Mr. S. Castillo, asked several questions concerning the agreement mentioned in the Narrative Outline, including issues of the requirements under the agreement and the need for a Section 7 consultation. The Navy also stated that the management of this and other listed species on Vieques has been incorporated into the Land Use Management Plan (LUMP) for the Naval Facilities on Vieques. *Calyptranthes thomasiana* is found within a designated conservation zone.

The National Park Service stated that they had reviewed the document and agreed with the steps outlined in the plan. The Park Service mentioned that they were in the process of developing an action plan to reduce the feral pig numbers at the Bordeaux Mountain site and that the project had a number of cooperators.

The Department of Planning and Natural Resources of the Virgin Islands provided specific comments on items in the plan and provided comments from Ms. Eleanor Gibney, a local authority on plant in St. John. Ms. Gibney provided information on numbers, reproduction, and habitat type. This information has been incorporated into the plan where appropriate.

PART II. RECOVERY

A. Recovery Objective

The objective of this recovery plan is to provide direction for reversing the decline of *Calyptranthes thomasiana* and for restoring the species to a self-sustaining status, thereby permitting it to be removed from the Federal Endangered Species List.

Calyptranthes thomasiana could be considered for downlisting when (1) an agreement between the Fish and Wildlife Service (Service) and the U.S. Navy (Navy) has been prepared and implemented for the protection of the known population on Vieques; (2) an agreement between the Service and the National Park Service (Park Service) has been prepared and implemented for the protection of the known population on St. John; and (3) new populations (the number of which should be determined following the appropriate studies) capable of self perpetuation have been established within protected areas, such as other areas on Vieques or St. John. These are minimum requirements, and could be expanded upon if the regenerative or propagative potential of natural and ex situ populations proves to be insufficient. Alternatively, if new populations of the species are discovered, it may be preferable to place greater emphasis of protection rather than on propagation in order to achieve the minimum number of plants necessary for recovery.

B. Narrative Outline

I. **Prevent further habitat loss and population decline.** Protection of habitat and individual plants at the known population sites should be initiated by appropriate public agencies (Service, Navy, Park Service).

II. **Protect habitat.** The protection of the existing populations should be given the highest priority.

III. **Develop a management plan which provides for the protection of *Calyptranthes thomasiana*, in cooperation with the Navy.** A management plan should be developed which includes measures to protect known individuals and their habitat and provides for long-term monitoring of their growth and reproduction.

112. **Develop a management plan which provides for the protection of *Calyptranthes thomasiana,* in cooperation with the Park Service.**. Develop a management plan, which provides for the protection of *Calyptranthes thomasiana*. In cooperation with the Park Service, a management plan should be developed which includes measures to protect known individuals

and their habitat and provides for long-term monitoring of their growth and reproduction. This plan should discuss measures which will be taken to exclude feral donkeys and pigs from the area where the species is found.

12. **Protect and monitor plants.** Individual plants and the recruitment of new individuals must be monitored on a long-term basis.

121. **Monitor known populations.** Individual plants should be measured and marked. Basic field observations which will contribute to the information available on population behavior (including phenology, seed production, seed dispersal, recruitment success, site changes, and growth), should be made at regular intervals.

122. **Enforce existing Commonwealth, Territorial, and Federal Endangered Species Regulations.** The Commonwealth Department of Natural Resources' Regulation to Govern the Management of Threatened and Endangered Species of 1985 provides for criminal penalties for the illegal take of listed plant species on public land. In addition, development projects which occur in these areas are often funded through local or Federal agencies or require local permits. The Regulation's Section 10 provides for consultations on endangered species which may be affected by a particular project similar to Section 7 of the Endangered Species Act. The Territory of the U.S. Virgin Islands protects territorial and federally listed species under Title 12, Chapter 2 of the Virgins Islands Code. Section 7 of the Endangered Species Act would apply where Federal lands or federally funded or permitted projects are involved.

123. **Educate the public on plant conservation values and regulations.** *Calyptranthes thomasiana* should be included in the illustrated brochure and slide presentation (in both English and Spanish) on endangered plants and plant communities that are presented to local school groups, organizations, and agencies. Permitting and funding agencies (those potentially involved in Section 7 consultations) should be made aware of endangered plants, the pertinent laws, and their responsibilities.

2. **Continue to gather information on the distribution and abundance of *Calyptranthes thomasiana* on Vieques and St. John.** Future management decisions and the establishment of recovery priorities depend on obtaining additional information concerning the distribution and abundance of this species.

   21. **Search for new populations.** Searches for new individuals and populations should be conducted on Vieques, St John and, in addition, St. Thomas.

      211. **Identify and inventory potential sites.** Based on a characterization of known habitat types, potential population sites should be identified and searched. The species' known habitat is limited in extent, therefore facilitating searches. Agencies and organizations that should be involved in these efforts include the Fish and Wildlife Service, the U.S. Navy, the National Park Service, local universities, and private conservation organizations.

      212. **Characterize sites to determine their suitability as future recovery sites.** If new populations are discovered, this information should be added to the database of the various agencies and organizations involved. In addition, newly discovered sites should be evaluated for the availability of propagative material and the potential for protection.

3. **Conduct research.** Little biological information is available on *Calyptranthes thomasiana*. Studies should focus on those aspects of life history that may be critical to the recovery of the species.

   31. **Define habitat requirements.** Information available from existing studies should be evaluated to more clearly define habitat requirements.

   32. **Study reproductive biology and ecology of *Calyptranthes thomasiana*.** Effective management and recovery of this species depends upon obtaining this information.

      321. **Assess periodicity of flowering.** Studies are needed to determine the frequency, timing, and abundance of flowering; pollination mechanisms; and the physical and biological factors controlling these events.

322. **Assess seed production and dispersal.** Agents of seed predation and/or dispersal should be identified.

323. **Evaluate seed viability and germination requirements.** Information on the environmental conditions required for germination should be obtained through field and laboratory studies.

324. **Evaluate requirements for seedling establishment and growth.** Field and laboratory experiments should focus on this critical stage to determine the factors that affect establishment and survival.

33. **Evaluate techniques for artificial propagation and develop propagation program.** Propagation techniques should be evaluated so that a propagation program with local nurseries may be developed.

331. **Assess methods of propagation.** Based on the availability of propagative material, economic and logistical considerations, and results from the above research, determine the most feasible method of propagation and transplantation to existing or new sites. Sexual versus asexual reproduction should be evaluated as alternatives.

332. **Develop artificial propagation program.** This species should be included in the ongoing artificial propagation program at local nurseries (e.g., the Department of Natural and Environmental Resources, St. Georges Botanical Garden).

4. **Establish new populations.** Areas for the establishment of new populations of *Calyptranthes thomasiana* should be selected and new populations established.

41. **Select appropriate sites for population introduction or enhancement using artificially propagated material.** Habitat requirements must be considered in order to assure the success and relevance of transplanting propagated material.

411. **Select sites and assess habitat suitability.** Using information from Task 31 above, inventory potential sites for the introduction and establishment of new

populations of *Calyptranthes thomasiana*. Serious consideration should be given to the introduction of this species on existing Navy land in Vieques and Park Service land on St. John.

412. **Ensure site protection.** If proposed sites are not already on protected land, steps must be taken to provide for their protection. Management plans for these new sites should be developed or modified to include considerations for this species.

413. **Introduce and monitor plants.** Success of plantings should be carefully monitored.

5. **Refine recovery goals.** As additional information on the biology, ecology, propagation, and management of *Calyptranthes thomasiana* is accumulated, it will be necessary to better define, and possibly modify, recovery goals.

51. **Determine number of individuals and populations necessary to ensure species stability and self-perpetuation.** Environmental and reproductive studies, together with the relative success of population protection measures, will allow more precise and realistic recovery goals to be established.

52. **Determine what additional actions, if any, are necessary to achieve recovery goals.** If there are any actions not included in this recovery plan which during the recovery process become recognized species needs, they should be incorporated into the plan.

C. Literature Cited and References

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Woodbury, R.O. and P.L. Weaver. 1987. The vegetation of St. John and Hassel Island. U.S. Virgin Islands, U.S. Department of the Interior, National Park Service, Southeast Regional Office, Research/Resources Management Report SER-83. 103 pp.

PART III. IMPLEMENTATION SCHEDULE

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
Priority 3 - All other actions necessary to provide for full recovery of the species.

List of Abbreviations

DNER -	Puerto Rico Department of Natural and Environmental Resources
DPNR -	Virgin Island Department of Planning and Natural Resources
Navy -	U.S. Navy
Park -	National Park Service, Department of the Interior
ES -	Fish and Wildlife Service, Endangered Species Division
LE -	Fish and Wildlife Service, Law Enforcement Division
BotGar -	Botanical Gardens
Univ. -	Universities

IMPLEMENTATION SCHEDULE

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization FWS R4	Other	Cost Estimates ($000) FY1	FY2	FY 3	Comments
1	Develop a management plan, which provides for the protection of Cayptranthes thomasiana in cooperation with the Navy.	111	2	ES	Navy				No cost anticipated
1	Develop a management plan, which provides for the protection of Cayptranthes thomasiana, in cooperation with the Park Service.	112	2	ES	Navy				No cost anticipated
2	Monitor known populations.	121	Cont.	ES	DNER, DPNR, Navy, Park	5	5	5	
2	Enforce existing Commonwealth, Territorial and Federal endangered species regulations.	122	Cont.	ES	DNER, DPNR, Navy, Park	6	6	6	
2	Educate the public on plant conservation values and regulations.	123	Cont.	ES,LE	DNER, DPNR, Navy, Park	1	1	1	
2	Identify and inventory potential sites.	211	2-4	ES	DNER, DPNR, Navy, Park	3	3	3	
2	Characterize sites to determine their suitability as future recovery sites.	212	2-4	ES	DNER, DPNR, Univ.				
2	Define habitat requirements.	31	2-4	ES	DNER, DPNR, Univ.	3	3	3	

Task Priority	Task Description	Task Number	Task Duration (Years)	Responsible Organization FWS R4	Other	Cost Estimates ($000) FY1	FY2	FY 3	Comments
2	Assess periodicity of flowering.	321	2-4	ES	DNER, DPNR, Univ.	6	6	6	6K/year includes 321, 322, 323, and 324.
2	Assess seed production and dispersal.	322	2-4	ES	DNER, DPNR, Univ.				
2	Evaluate seed viability and germination requirements.	323	2-4	ES	DNER, DPNR, Univ.				
2	Evaluate requirements for establishment and growth.	324	2-4	ES	DNER, DPNR, Univ.				
2	Assess methods of propagation.	331	2-4	ES	DNER, DPNR, Univ. BotGar.	2	2	2	
2	Develop artificial propagation program.	332	Cont.	ES	DNER, DPNR, Univ. BotGar.	2	2	2	
2	Select sites and assess habitat suitability.	411	2-4	ES	DNER, DPNR, Univ.		2		
2	Ensure site protection.	412	2-4	ES	DNER, DPNR, Navy , Park				
2	Introduction of plants.	413	2-4	ES	DNER, DPNR, Park				
2	Determine number of individuals and populations to ensure stability and self-perpetuation.	51	Cont.	ES	DNER, DPNR, Park, Univ.				
2	Determine what additional actions are needed to achieve recovery objectives.	52	Cont.	ES	DNER, DPNR, Univ. Park				

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